Abstract. We answer the natural question: when is a transversely holomorphic symplectic foliation induced by a generalized complex structure? The leafwise symplectic form and transverse complex structure determine an obstruction class in a certain cohomology, which vanishes if and only if our question has an affirmative answer. We first study a component of this obstruction, which gives the condition that the leafwise cohomology class of the symplectic form must be transversely pluriharmonic. As a consequence, under certain topological hypotheses, we infer that we actually have a symplectic fibre bundle over a complex base. We then show how to compute the full obstruction via a spectral sequence. We give various concrete necessary and sufficient conditions for the vanishing of the obstruction. Throughout, we give examples to test the sharpness of these conditions, including a symplectic fibre bundle over a complex base which does not come from a generalized complex structure, and a regular generalized complex structure which is very unlike a symplectic fibre bundle, i.e., for which nearby leaves are not symplectomorphic.